Geologic Characterization of the South Georgia Rift Basin for Source Proximal CO_2 Storage

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Regional Carbon Sequestration Partnerships
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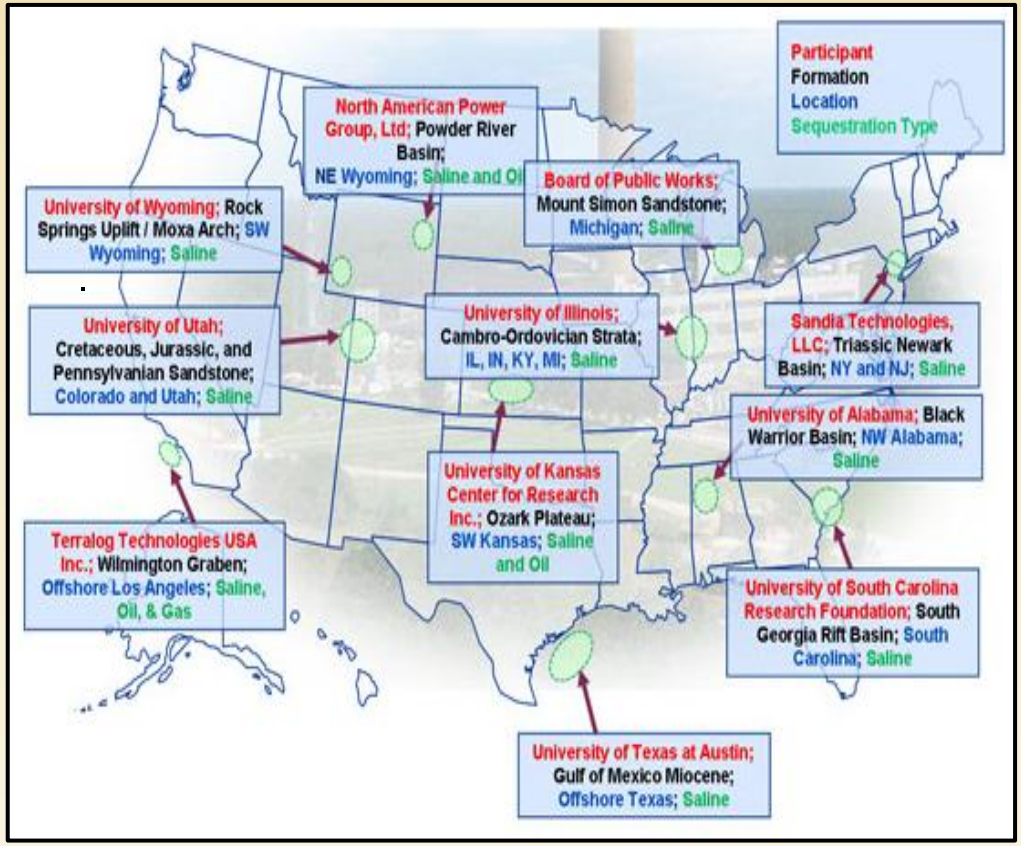
Sponsor

U.S. Department of Energy, National Energy Technology Laboratory

"Site Characterization of Promising Geologic Formations for CO_2 Storage"

December 8, 2009 through December 7, 2011
$9,950,639 DOE/NETL Award

The Department of Energy is funding 10 projects valued at $125.5 million aimed at increasing scientific understanding about the potential of promising geologic formations to safely and permanently store carbon dioxide.



South Carolina Research Team

University of South Carolina

SCHOOL OF THE ENVIRONMENT
EARTH SCIENCES AND RESOURCES INSTITUTE

COLLEGE OF ARTS AND SCIENCES
EARTH AND OCEAN SCIENCES

SCDNR
SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES

SCGS
SOUTH CAROLINA GEOLOGICAL SURVEY

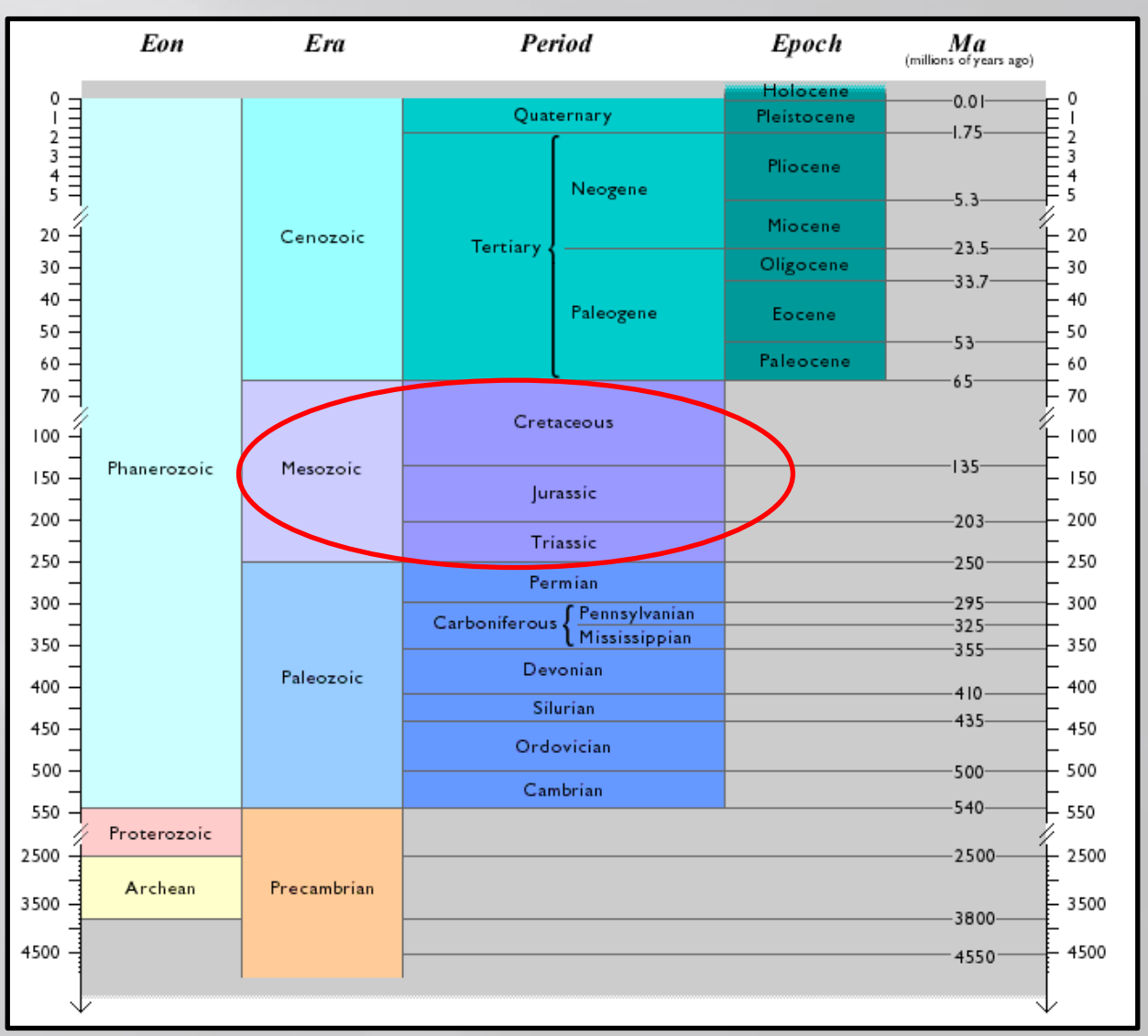
ILLINOIS STATE GEOLOGICAL SURVEY

Bay Geophysical, Inc.

Weatherford
LABORATORIES

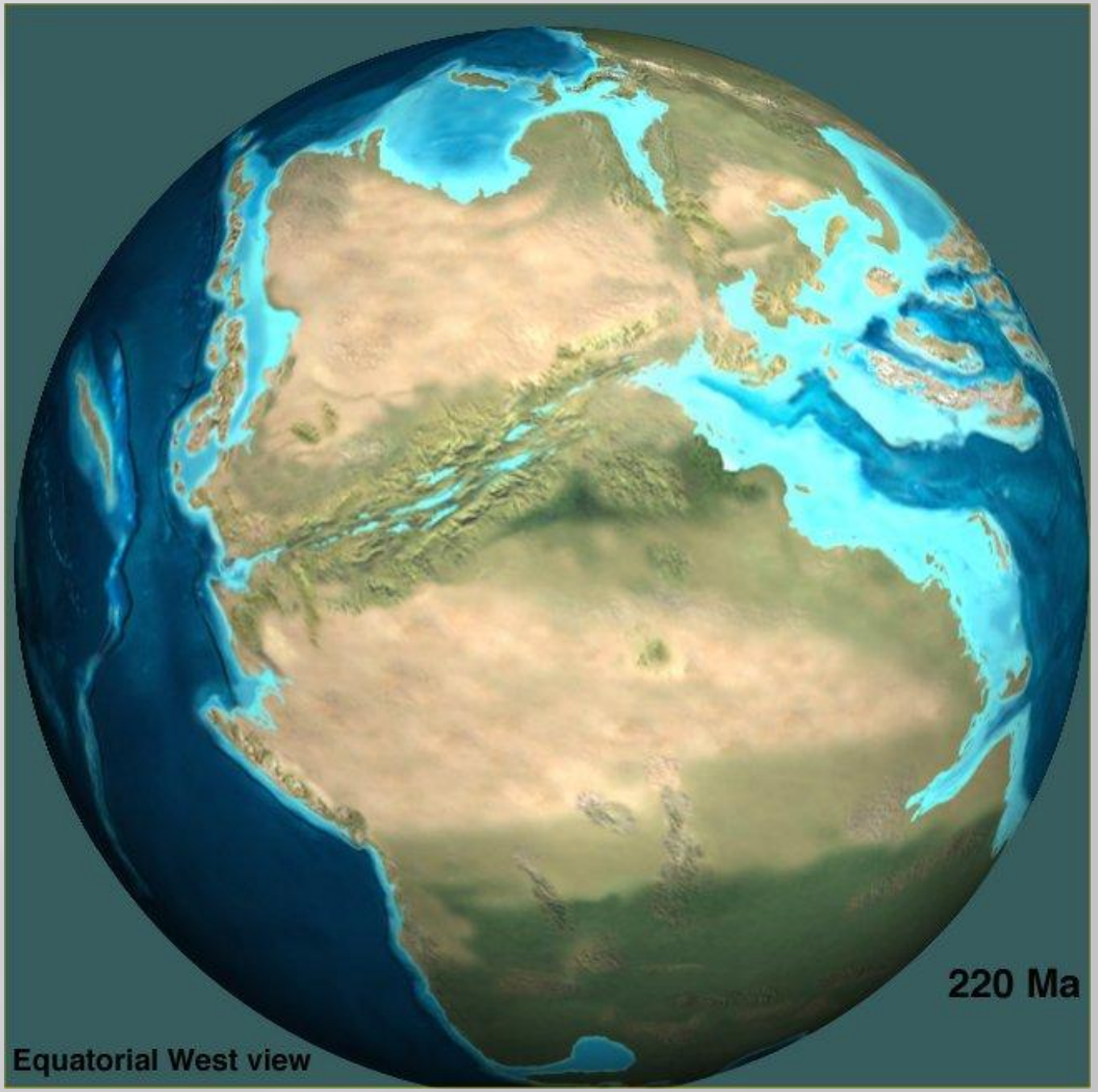
SCCO2

South Georgia Rift Basin (SGR) – Buried Mesozoic basin extending west-southwesterly from South Carolina into Georgia that formed along zones of faulting and subsidence during the period of crustal extension associated with the breakup of Pangea.

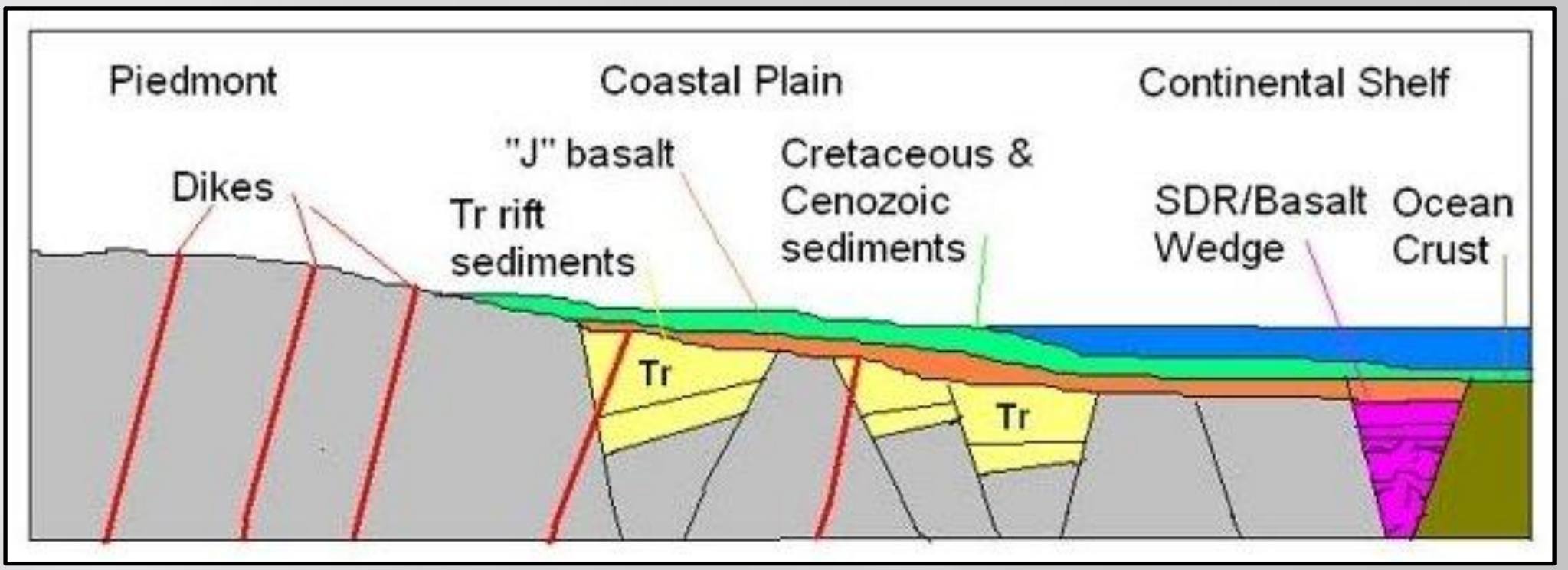


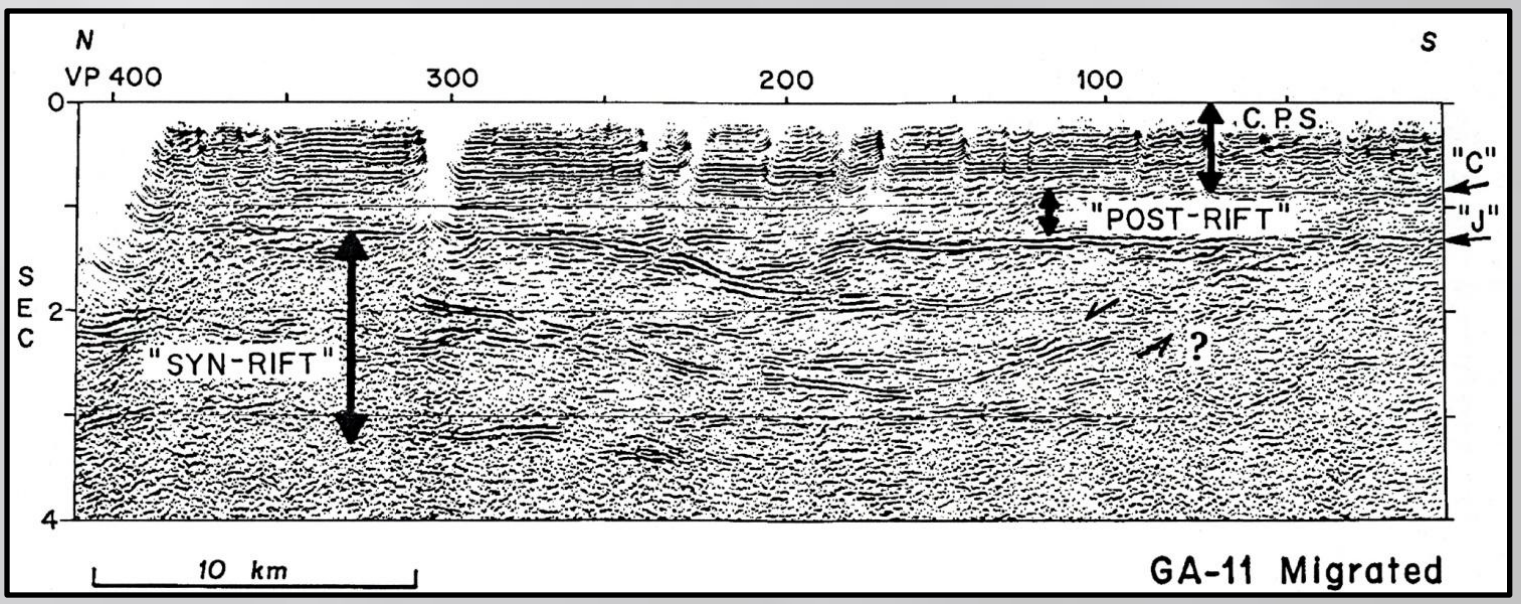
Triassic

- 250-202 Ma
- Pangea breakup



SGR Basin Description (cont'd)

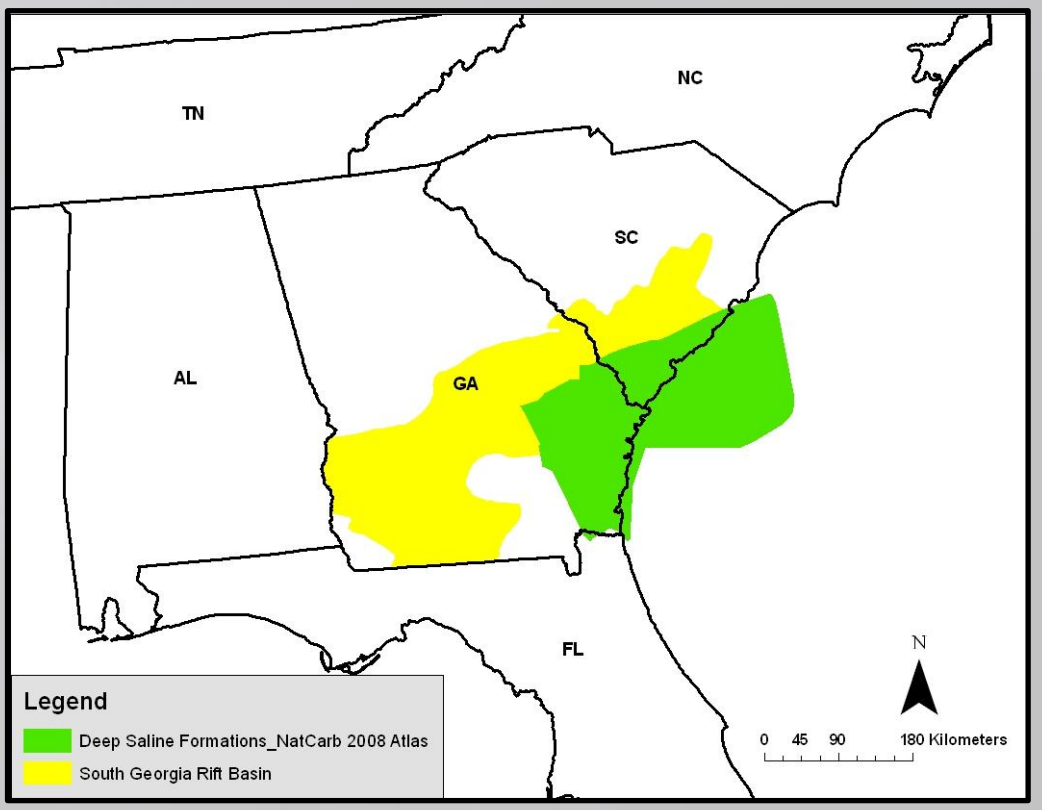




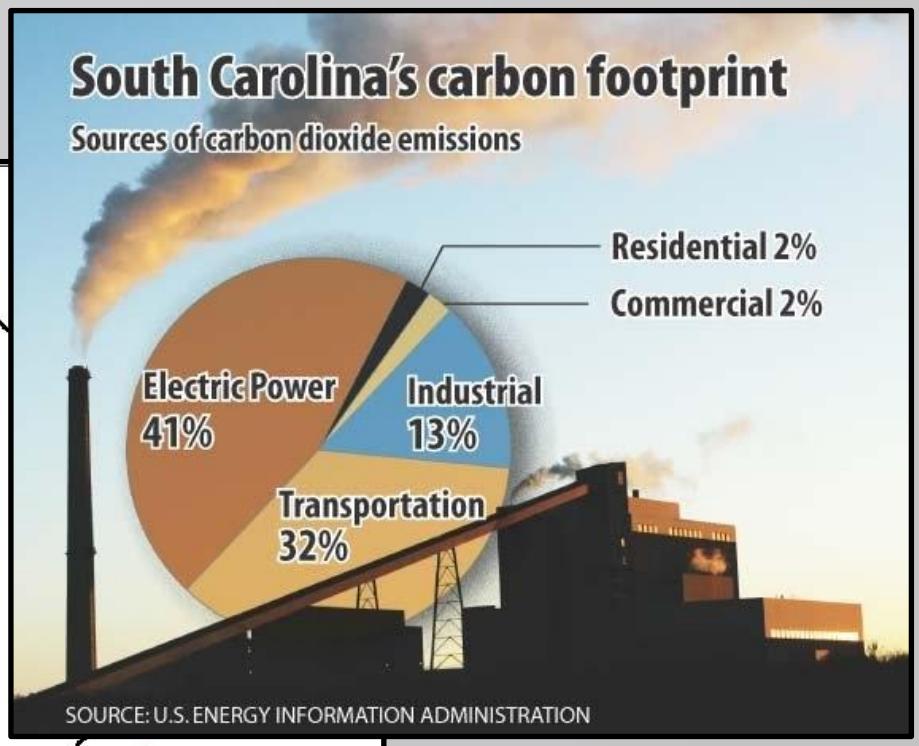
Continental Reflection Profiling (COCORP) line GA-11 located in southern Georgia from McBride, et al., 1989. This 1980's vintage seismic line images the base of the Coastal Plain sediments "C" and the post rift sediments and "J" Basalt extending into southern Georgia.

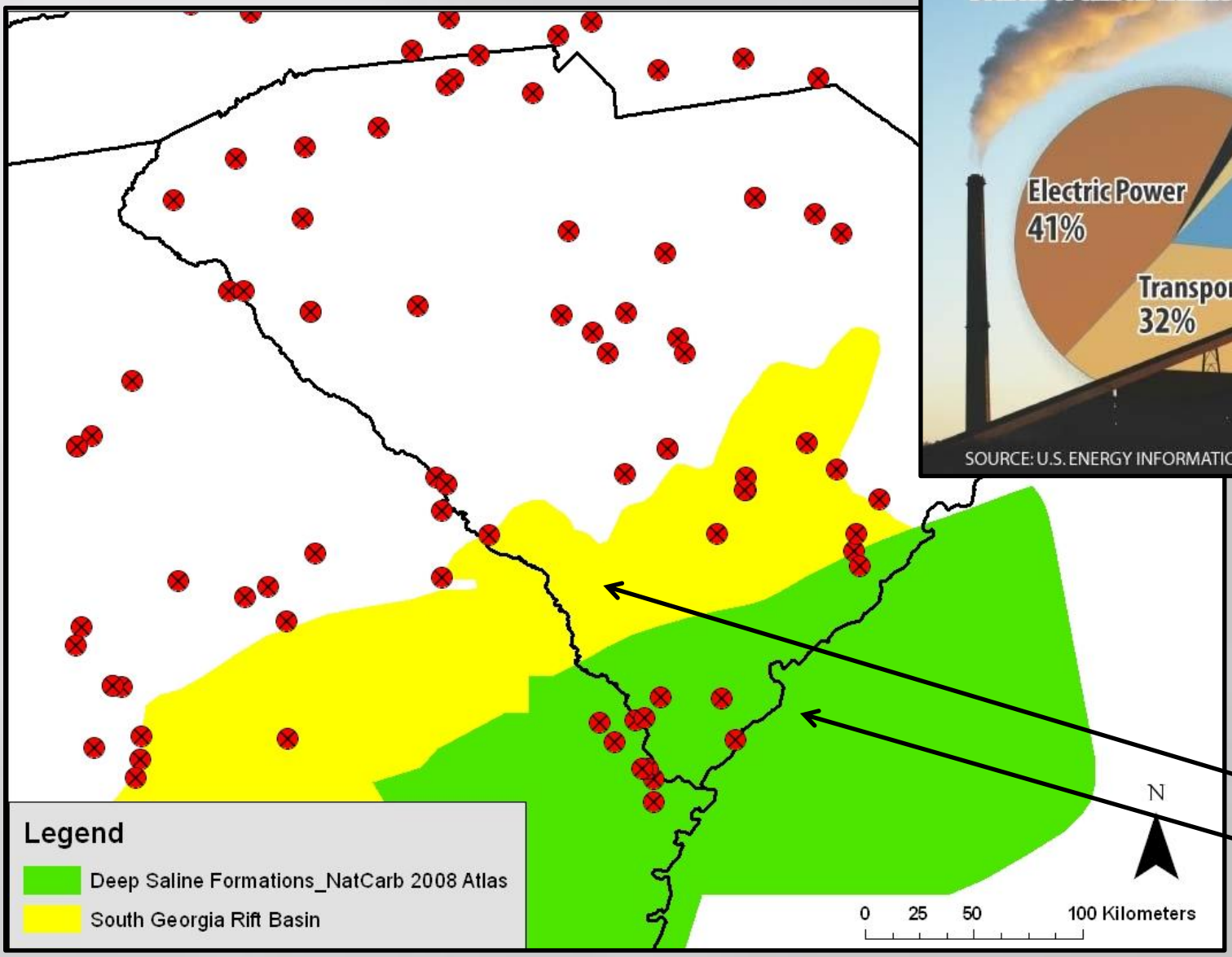
SGR Basin Description Overview

- Buried entirely beneath the Southeast Coastal Plain
- Covers area over 160,000 km^2
- Thickness of the basin fill may be up to 6 km
- Basin fill mostly fine to coarse grained sandstones, conglomeritic sandstones, mudstones, and siltstones – redbeds with intercalated layers of basalt/diabase
- Partially overlain by Jurassic basalt ("J" horizon) that is up to 250 m thick in some parts of the basin



CO_2 Stationary Sources in South Carolina





Representations of the SGR Basin

Chowns and Williams, 1983

NatCarb Atlas, 2008

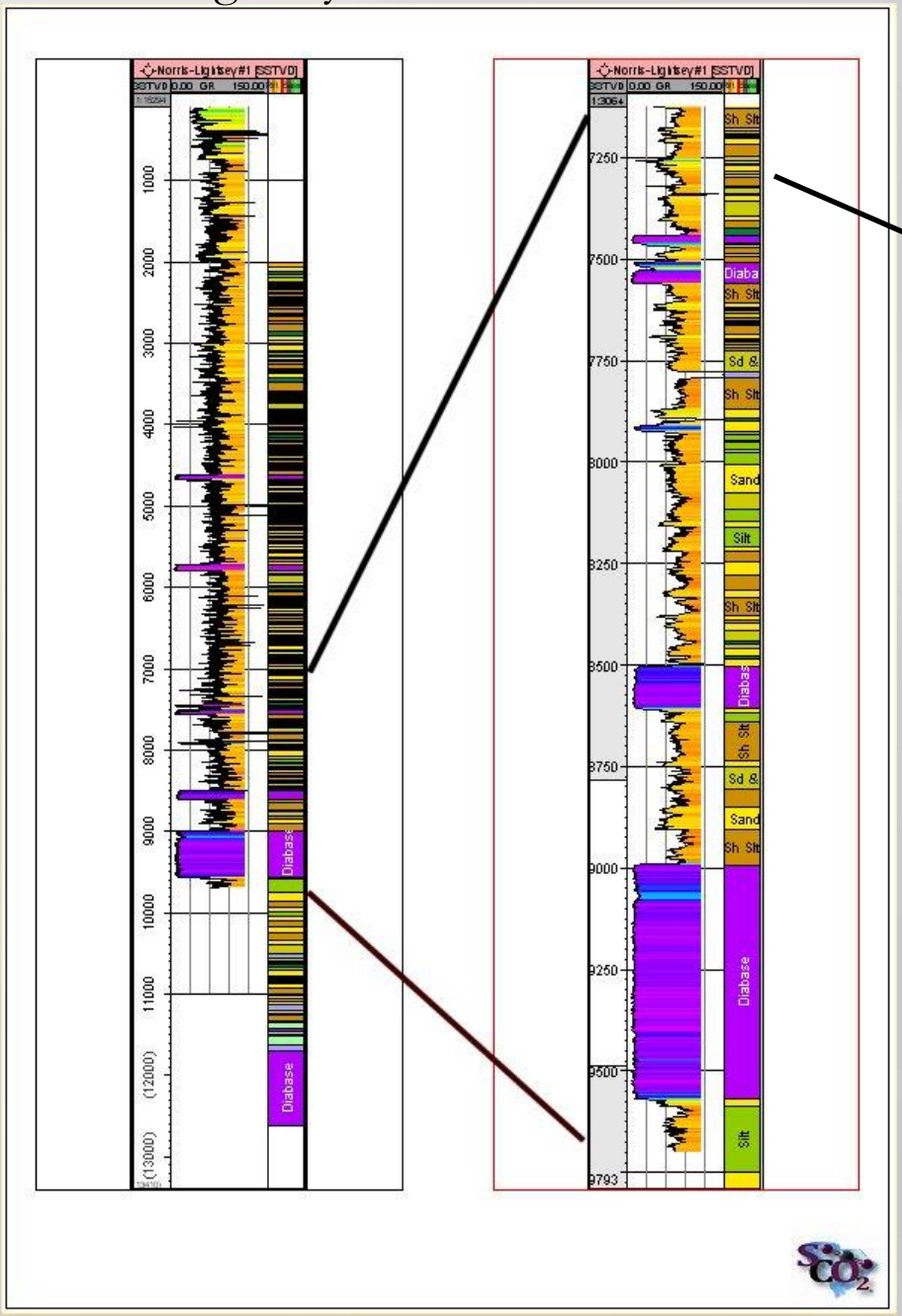
Geologic Characterization Hypothesis

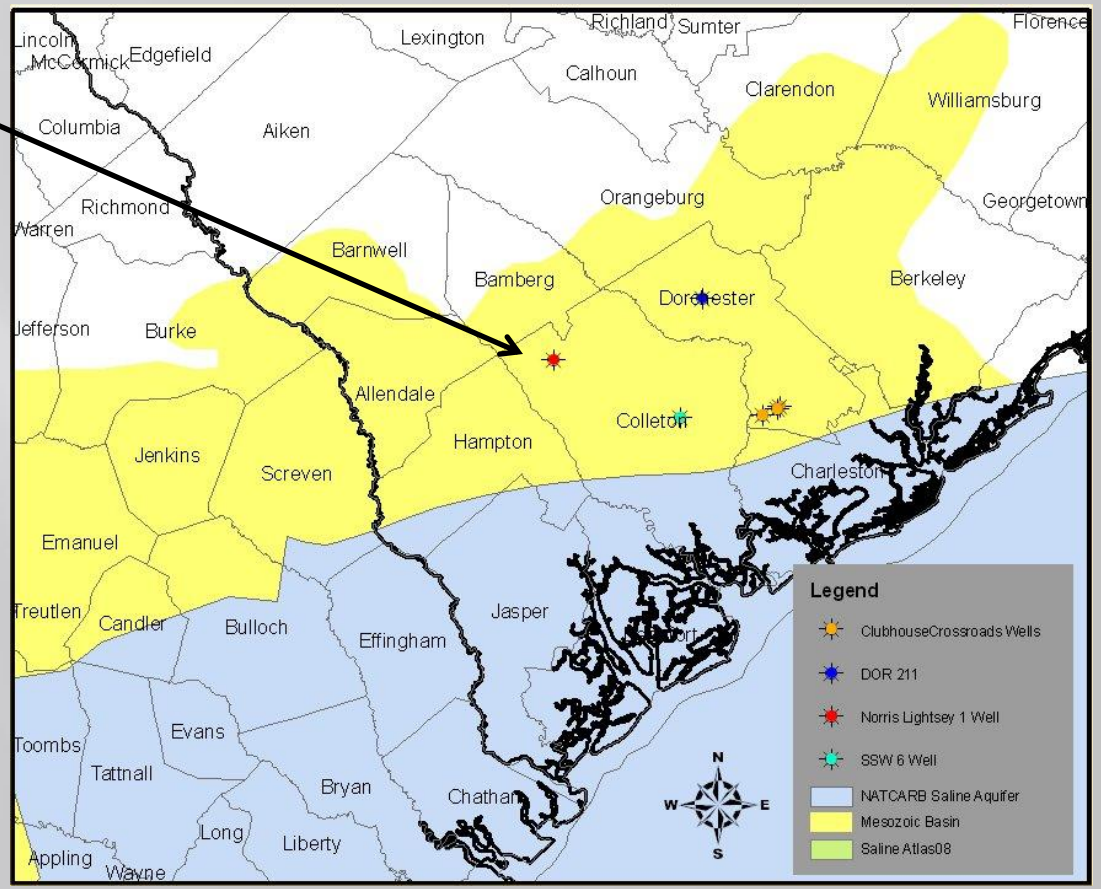
South Georgia Rift Basin is capable of storing large quantities of CO_2 and multiple caprock formations are present to maintain the integrity of the storage of CO_2 as a supercritical fluid.

Preliminary Understanding of the Geology of the Study Area

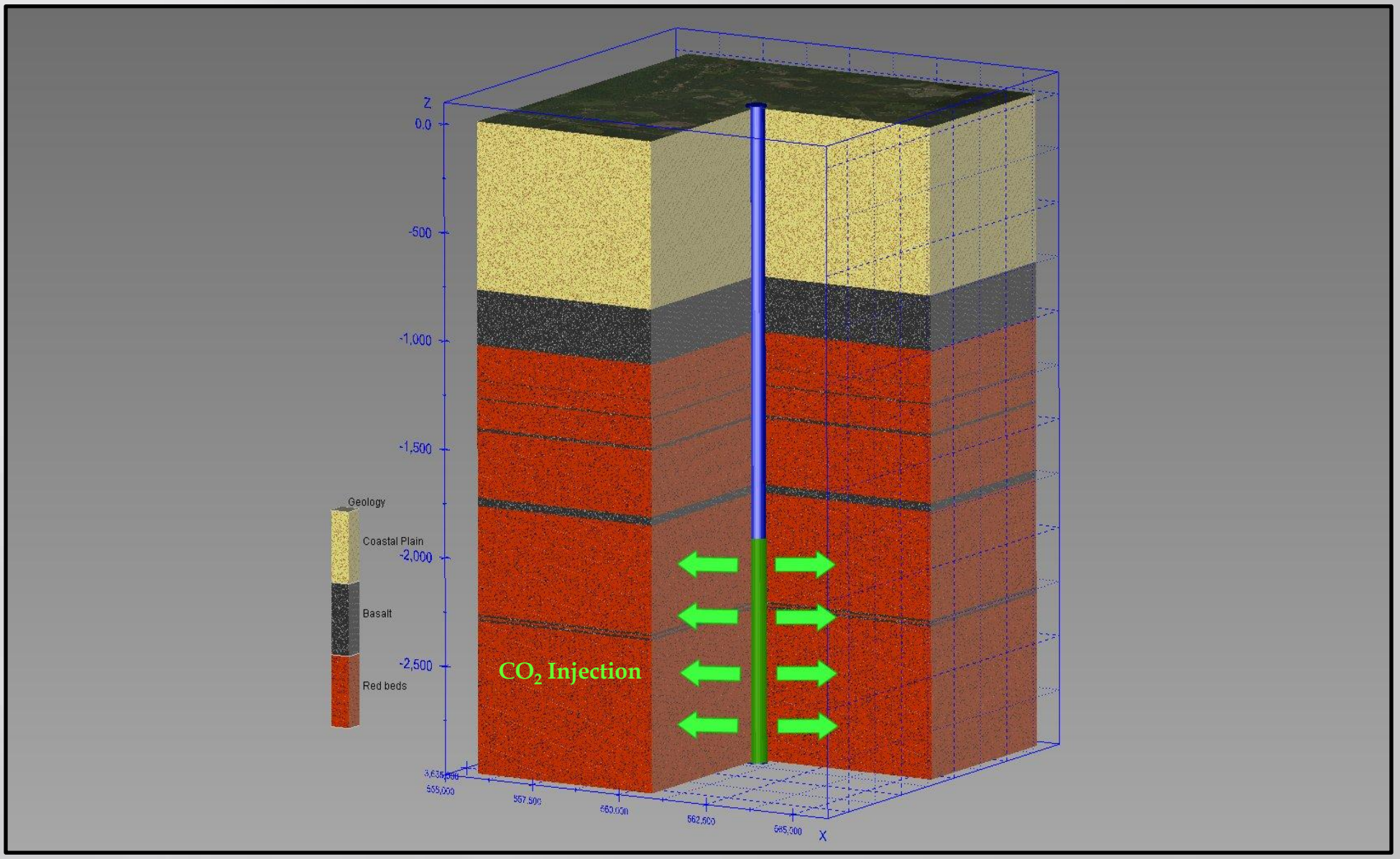
(Based on sparse data)

Norris Lightsey No. 1





Initial Conceptual Solid Earth Model for SGR CO_2 Storage and Containment



South Georgia Rift Basin Characterization Approach

Three Phases Over Three Years

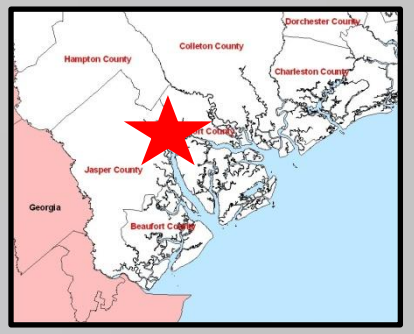
1. Preliminary geologic storage assessment based on existing data and analyses including re-interpretation and integration of existing data (Year 1)

2. Regional characterization of target CO_2 storage formation (Year 2)

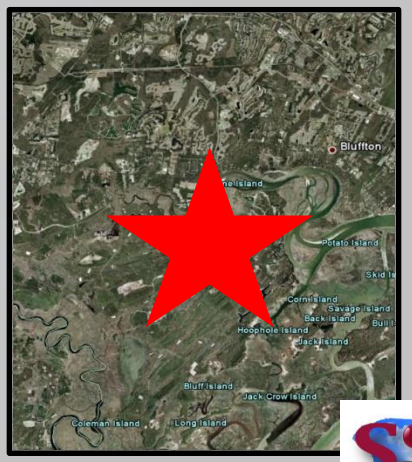
3. Site-specific characterization via drilling, coring, logging geotechnical test hole (Year 3)

Phase 1

Phase 2



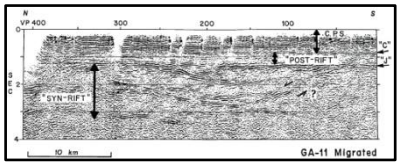
Phase 3



Spatial Scale Refinement

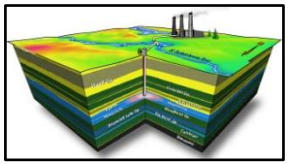
Phase 1 Initial Assessment Work Flow

Gather and Assess Existing Geologic/Geophysical Data

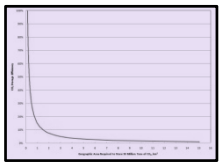


Determine Structural Controls on Mesozoic Reservoirs with Known Analogs

Identify Favorable Injection Zones and Containment Effectiveness



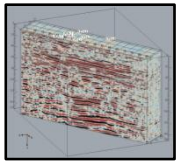
Estimate CO_2 Storage Capacity



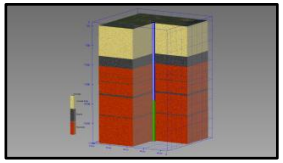
"Go/No Go" Decision

Phase 2 Data Integration and Solid Earth Modeling Work Flow

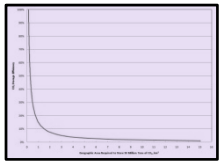
Integrate New Seismic Data with Phase 1 Existing Data



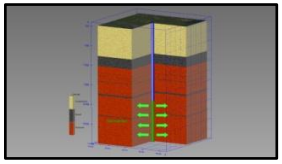
Refine Solid Earth Model



Update CO_2 Capacity Estimates



Simulate Injectivity into Formation



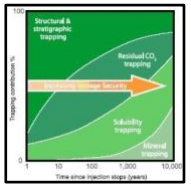
"Go/No Go" Decision

Phase 3 Site-Specific Characterization Work Flow

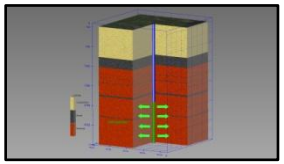
Drill/Log/Core Test Hole

Assess Caprock and Storage Formation Properties and Brine Interaction

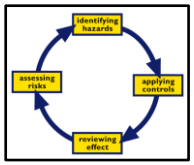
Evaluate Leakage Pathways



Finalize Conceptual Model of SGR and Simulate Injection

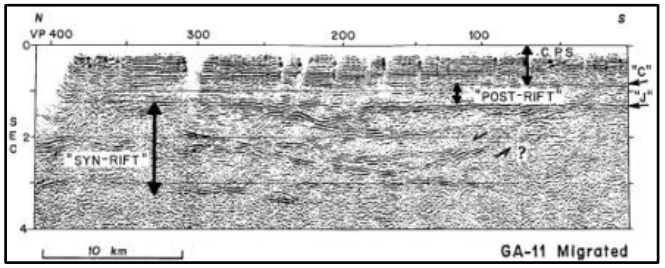


Identify Site Attributes that Pose Risks to Operations



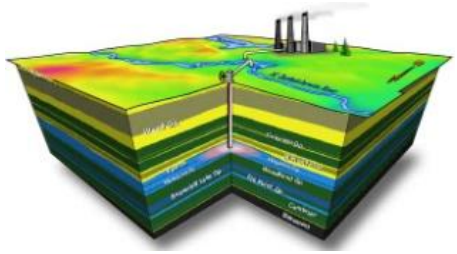
Phase 1 Activities Underway

Gather and Assess Existing Geologic/Geophysical Data

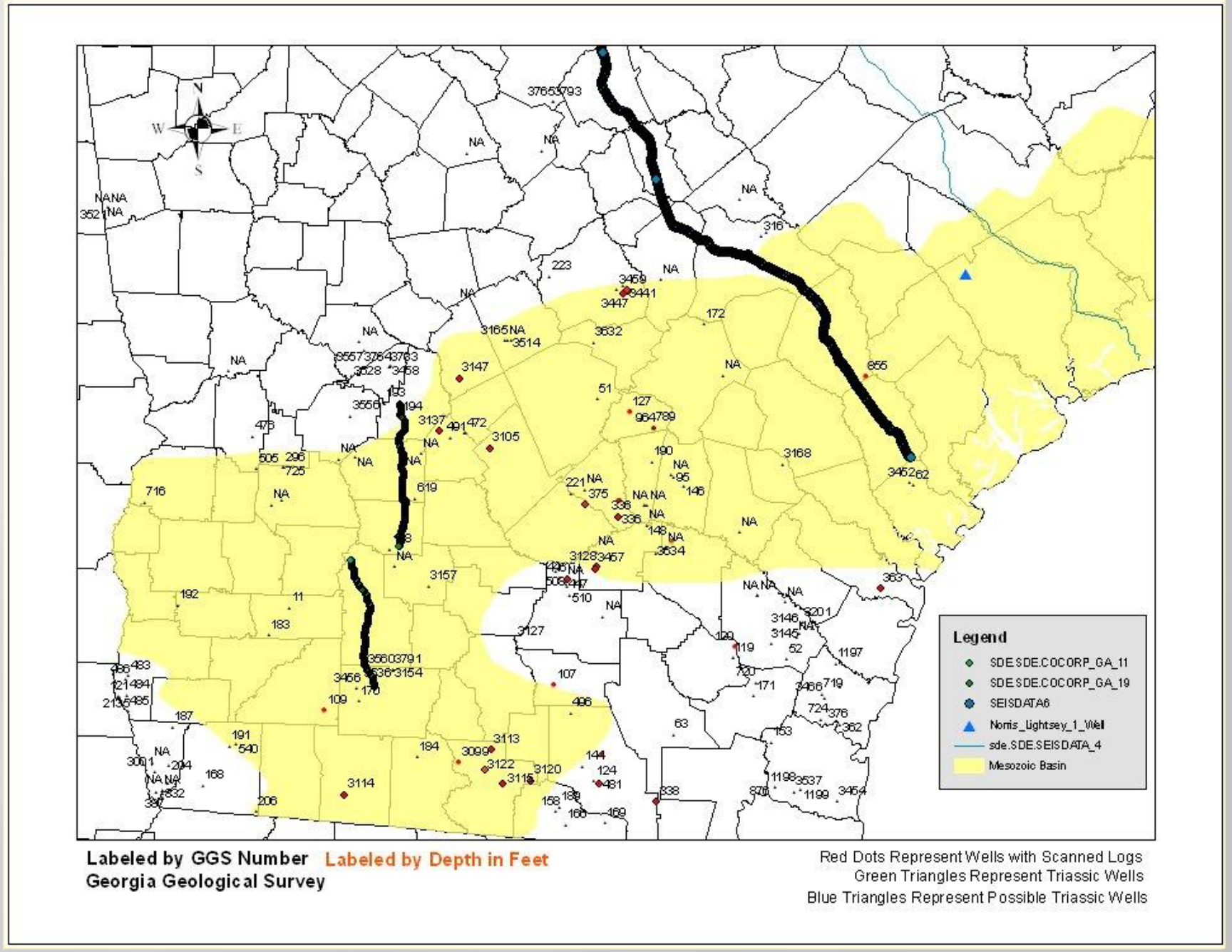


Determine Structural Controls on Mesozoic Reservoirs with Known Analogs

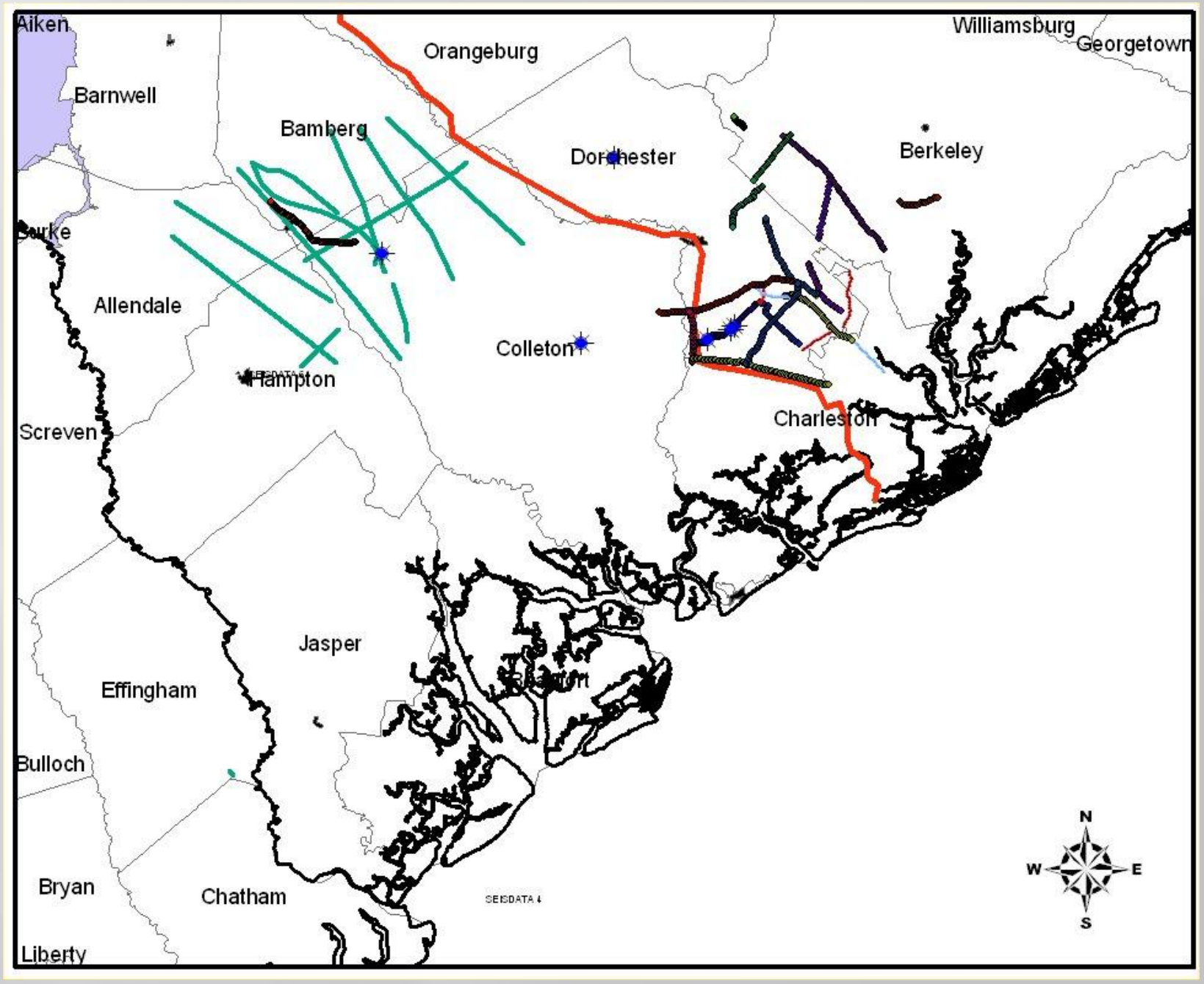
Identify Favorable Injection Zones and Containment Effectiveness



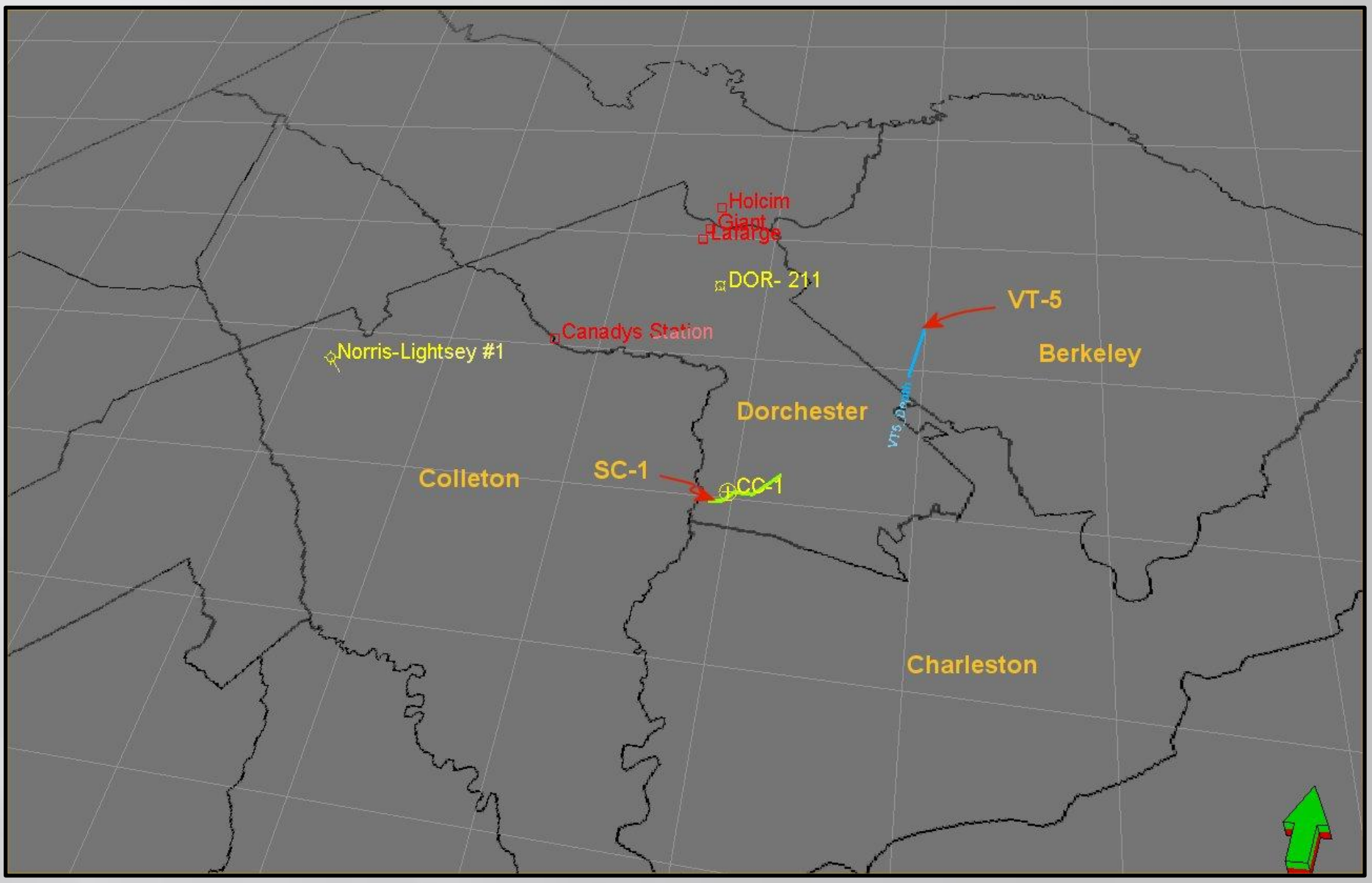
Partial List of Existing Data in Georgia



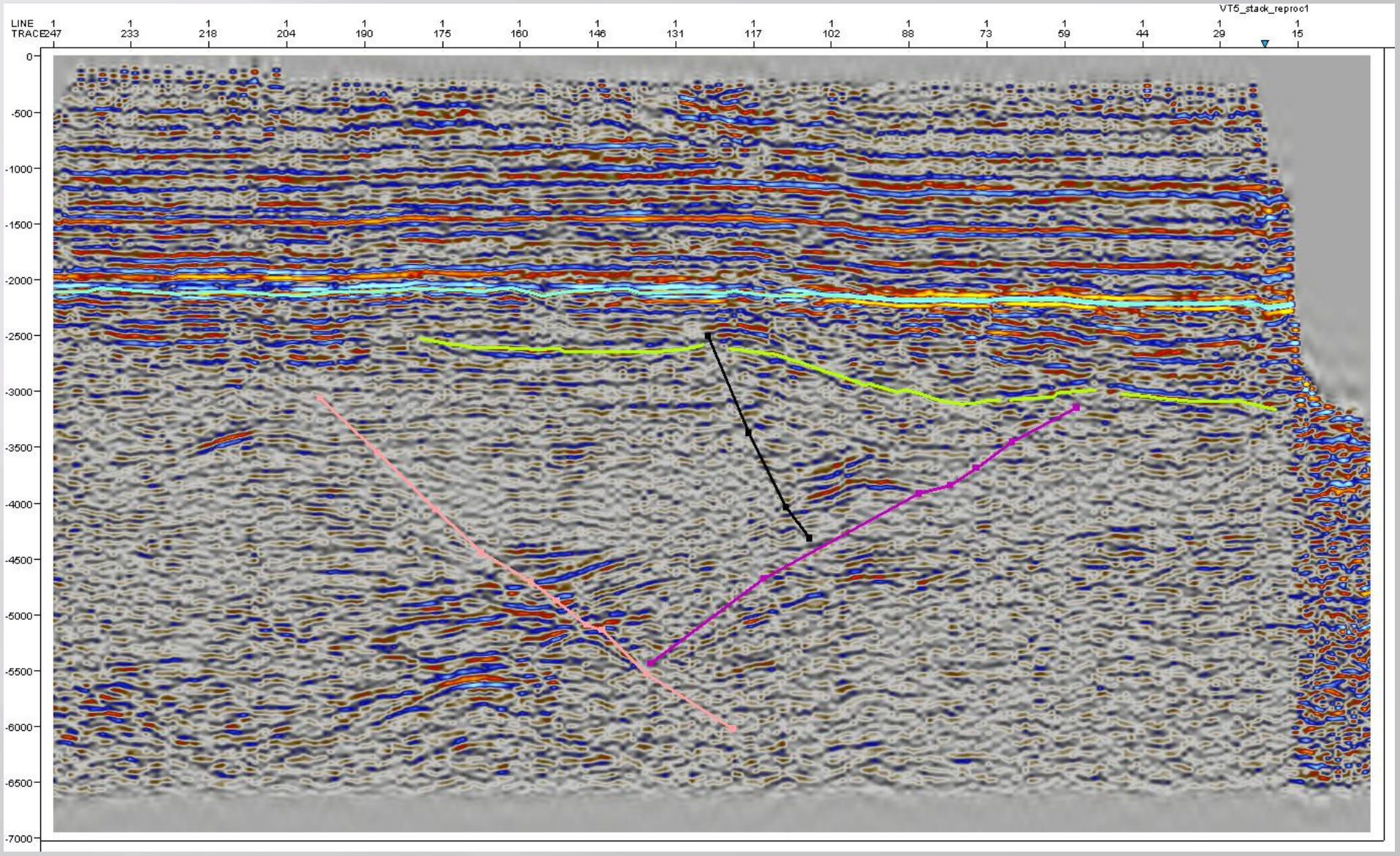
Existing Data in South Carolina



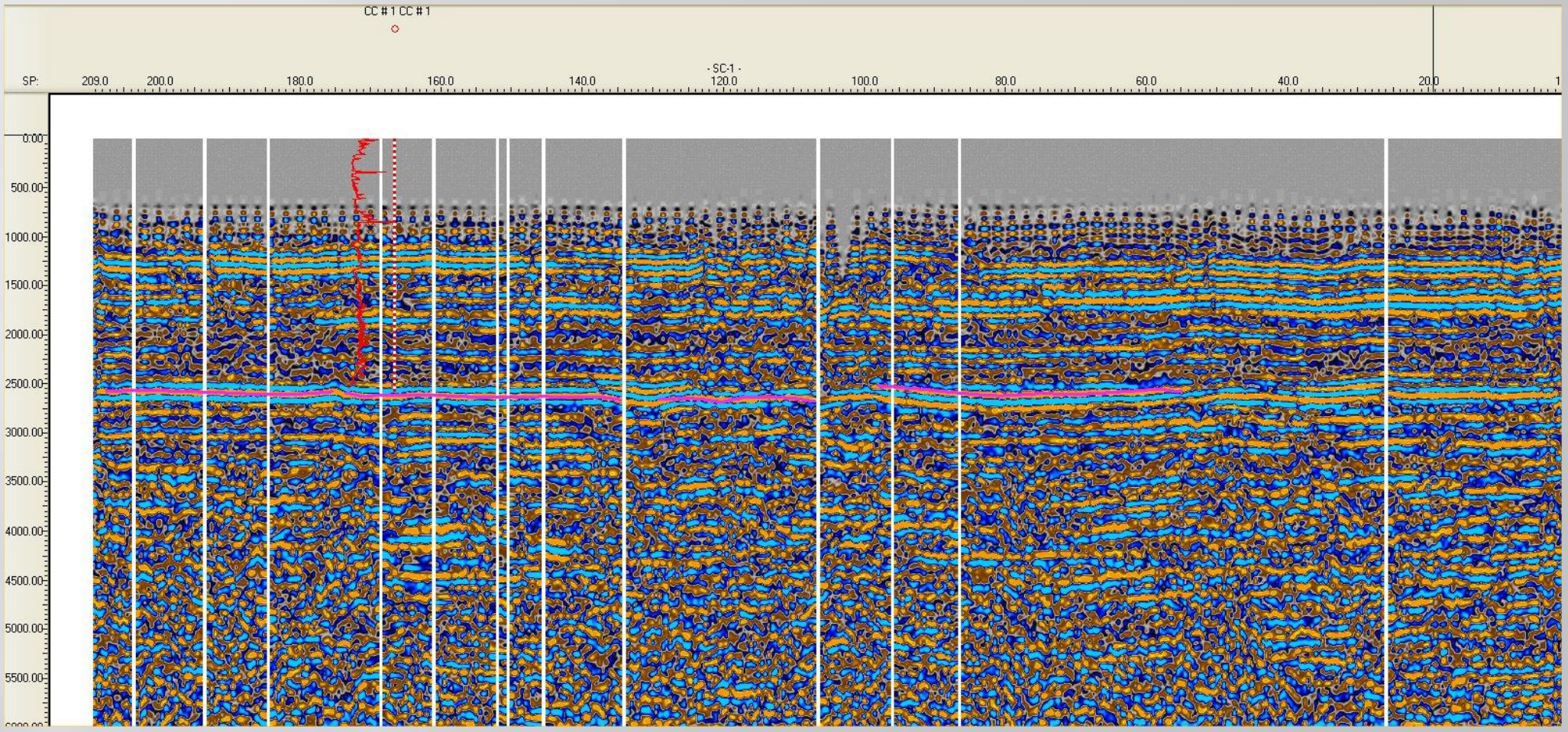
Examples of the Variable Seismic Data Quality



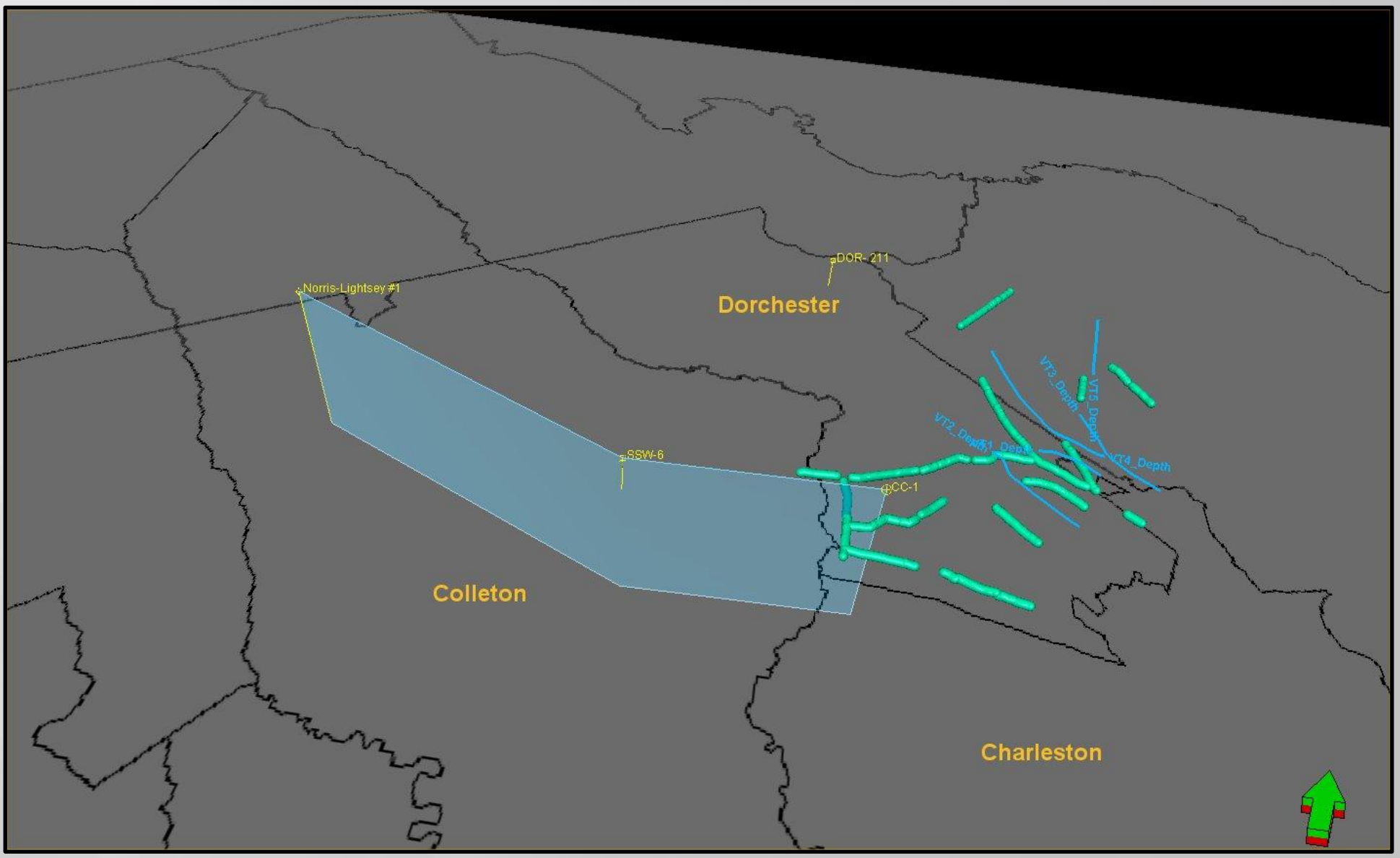
Seismic Line VT-5



Seismic Line SC-2



Determining Structural and Stratigraphic Controls



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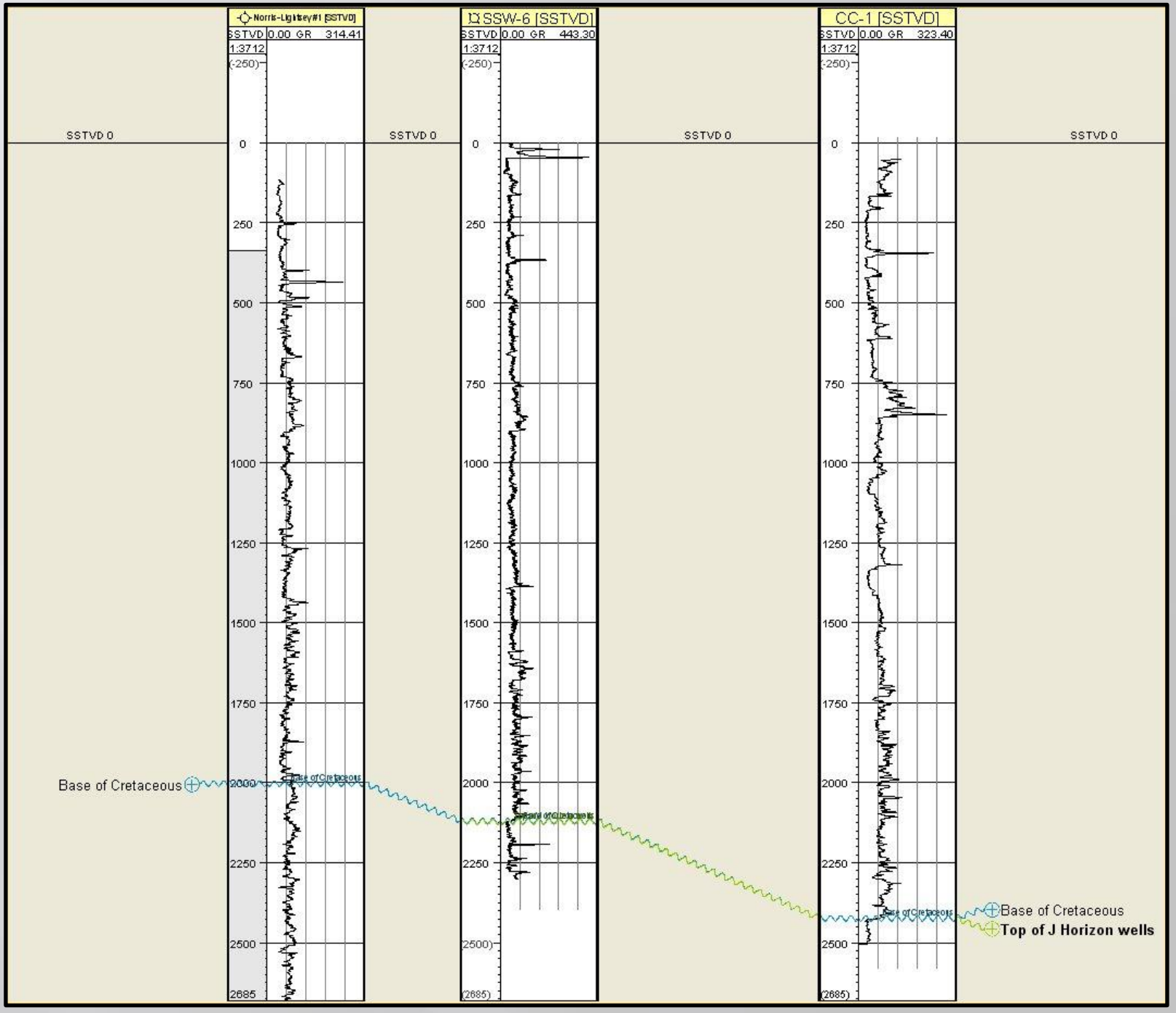
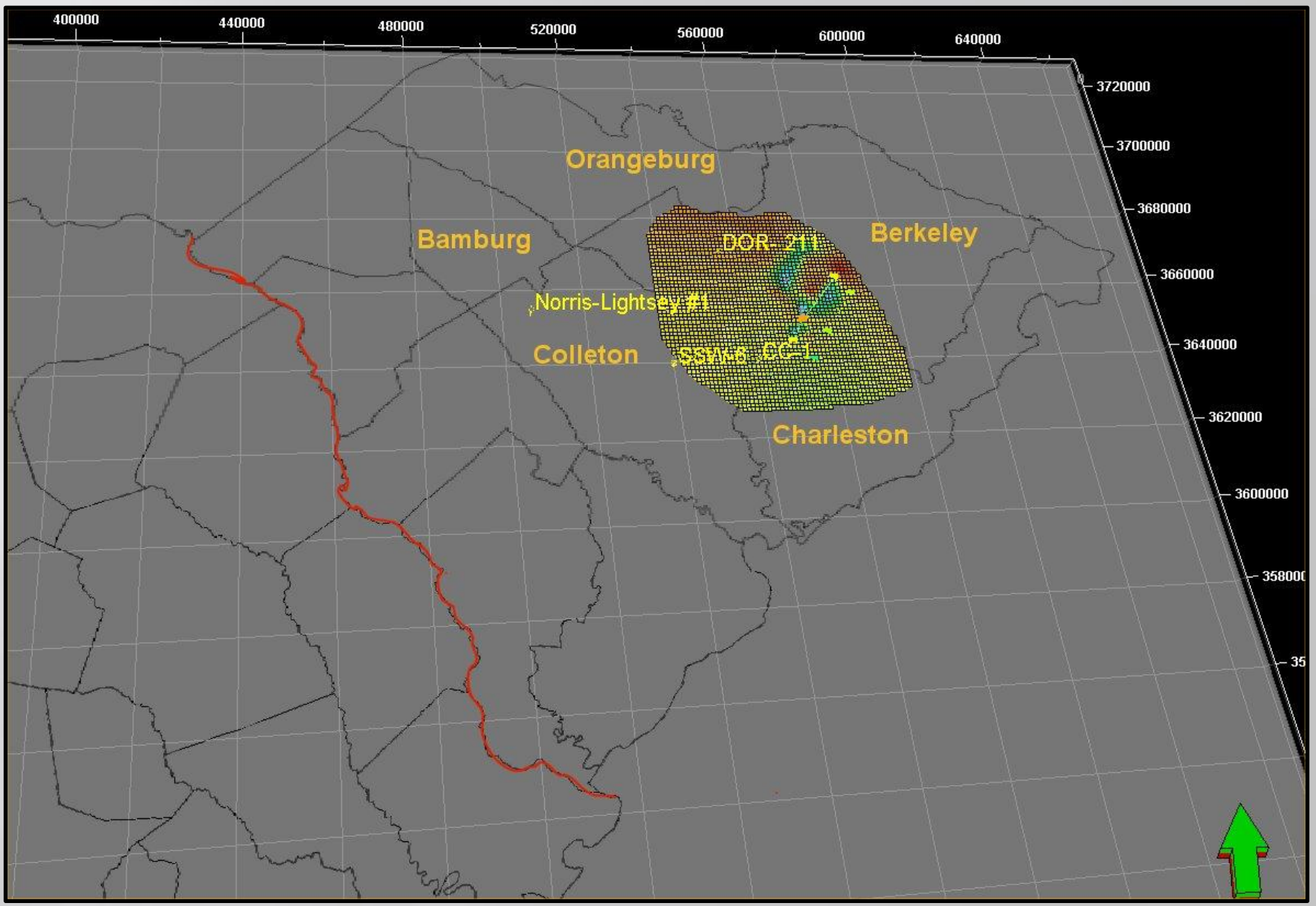
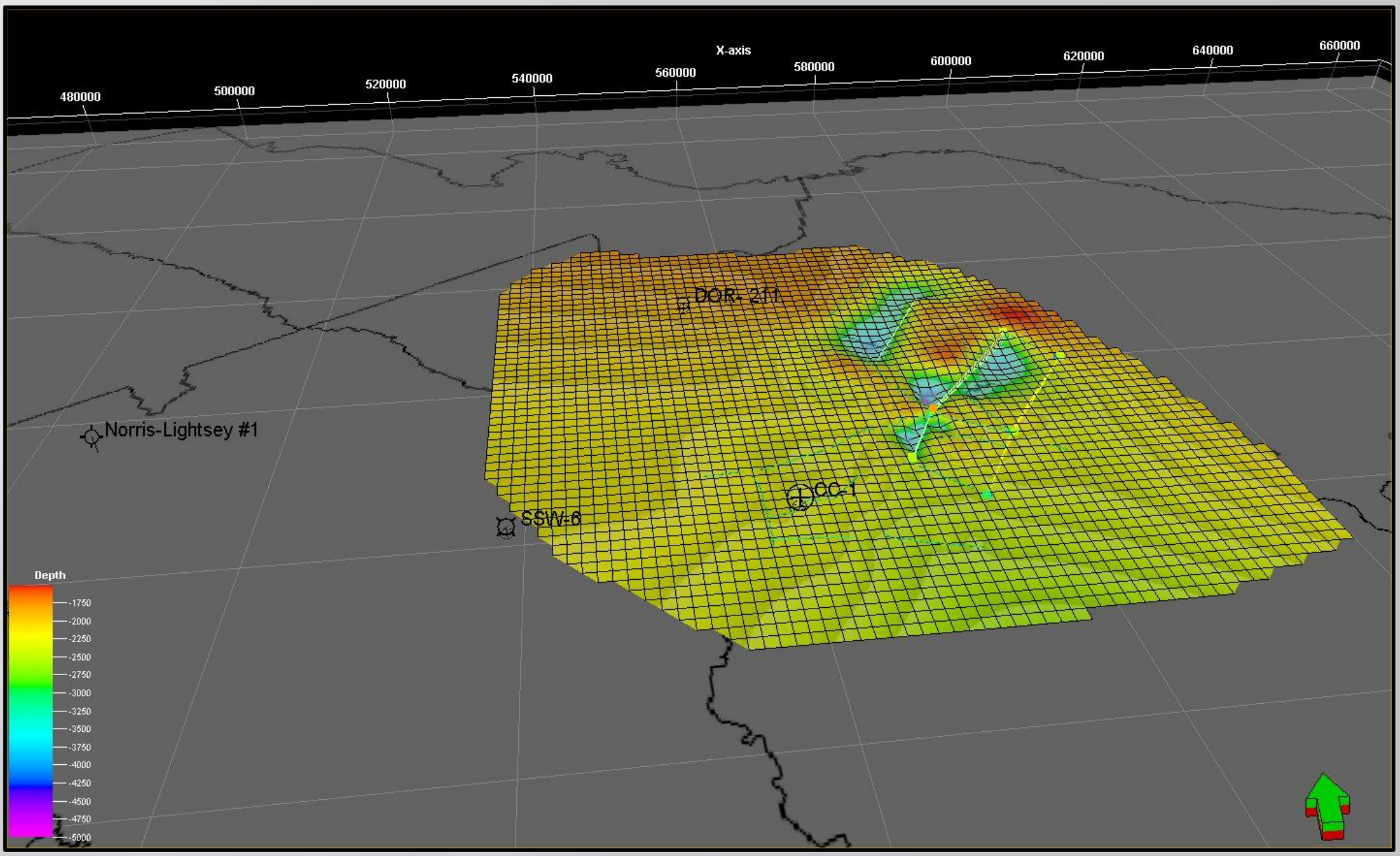


Phase 1: Preliminary Refinement of the Solid Earth Model

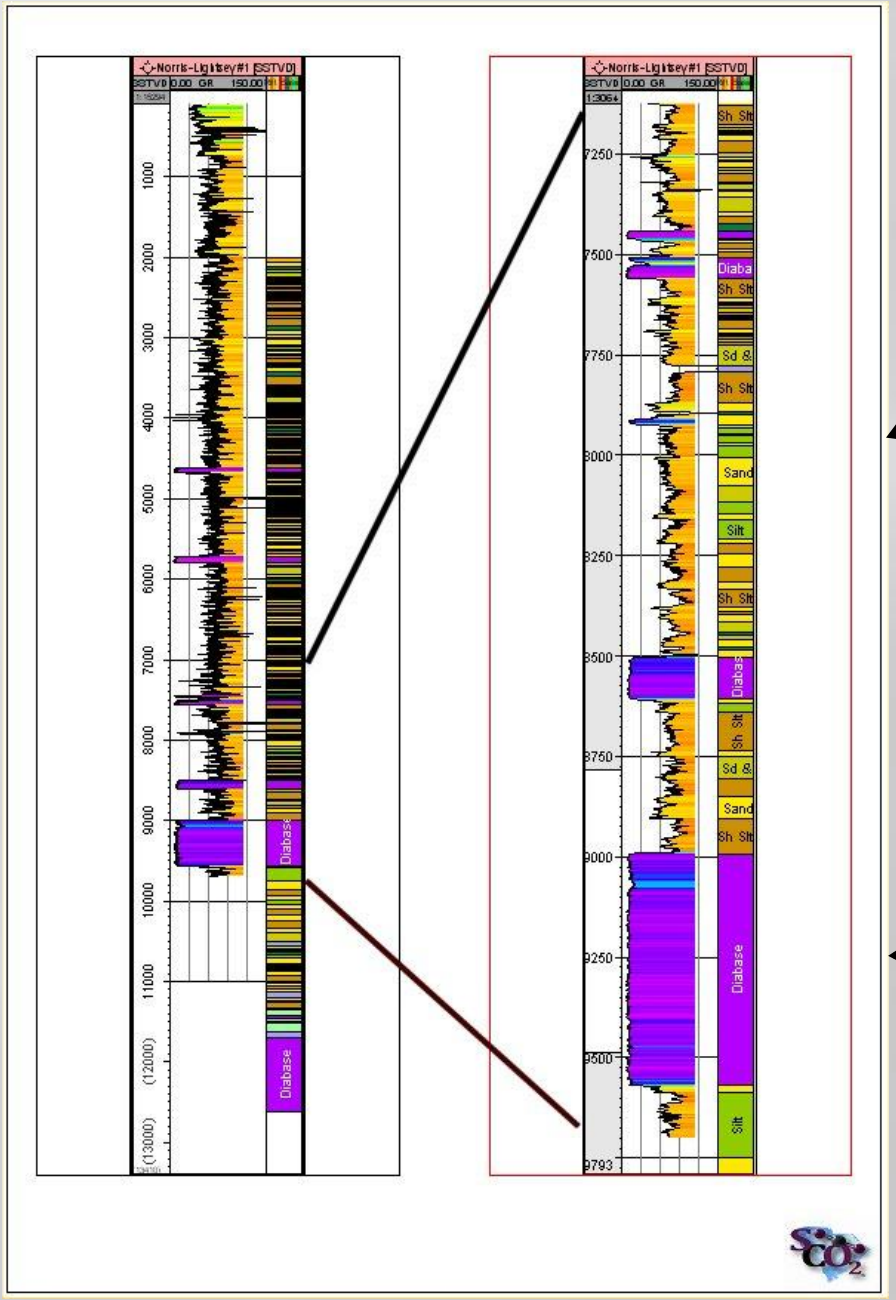


Top of the "J" Horizon



Phase 1: Assessing Potential Caprock and Reservoir Quality

Analogs from the Newark Basin?



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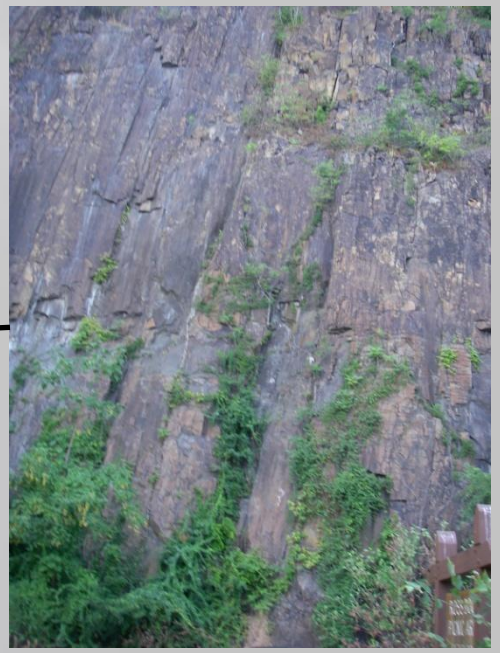

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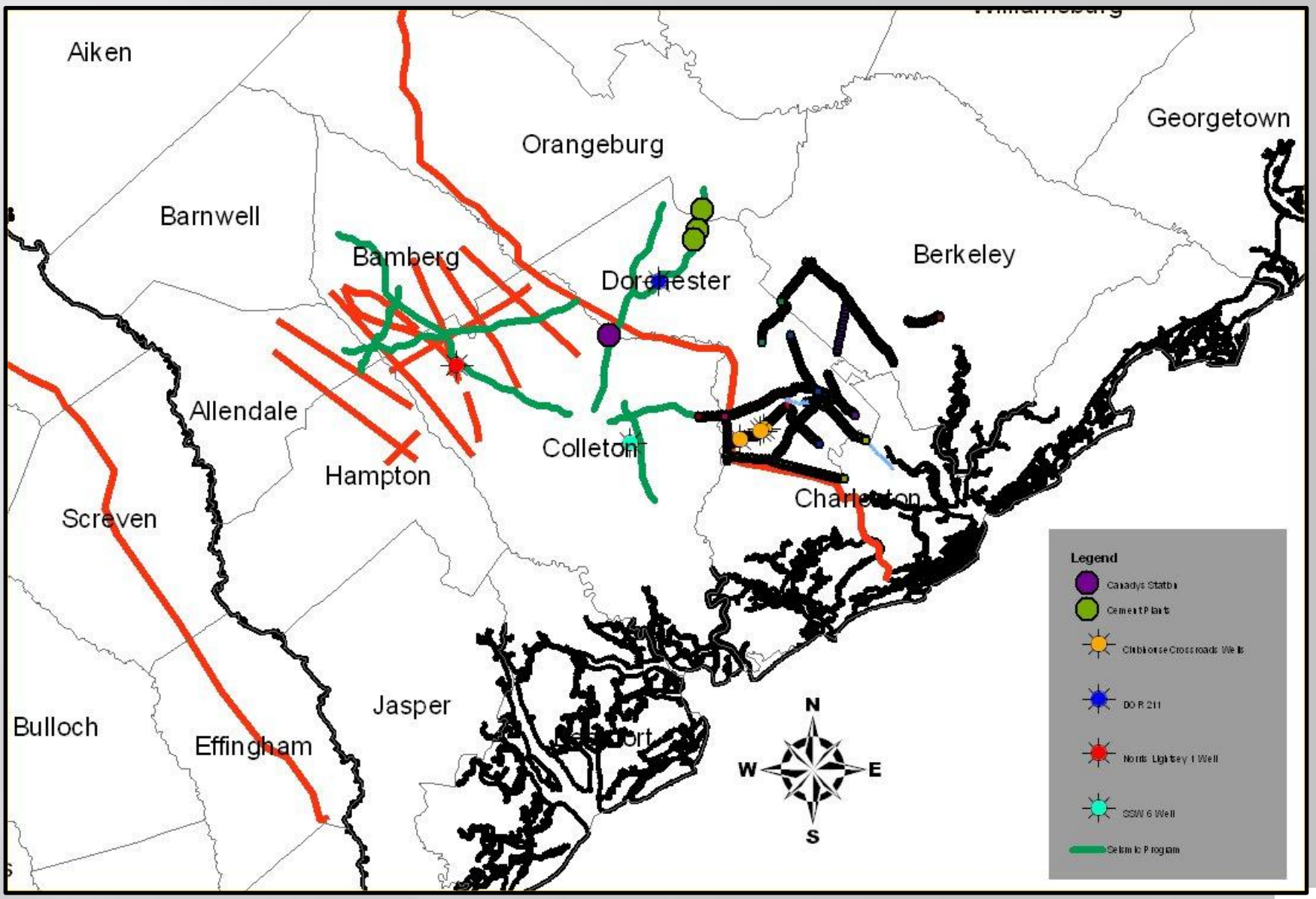
Phase 2: Acquisition and Processing of Additional Seismic Data

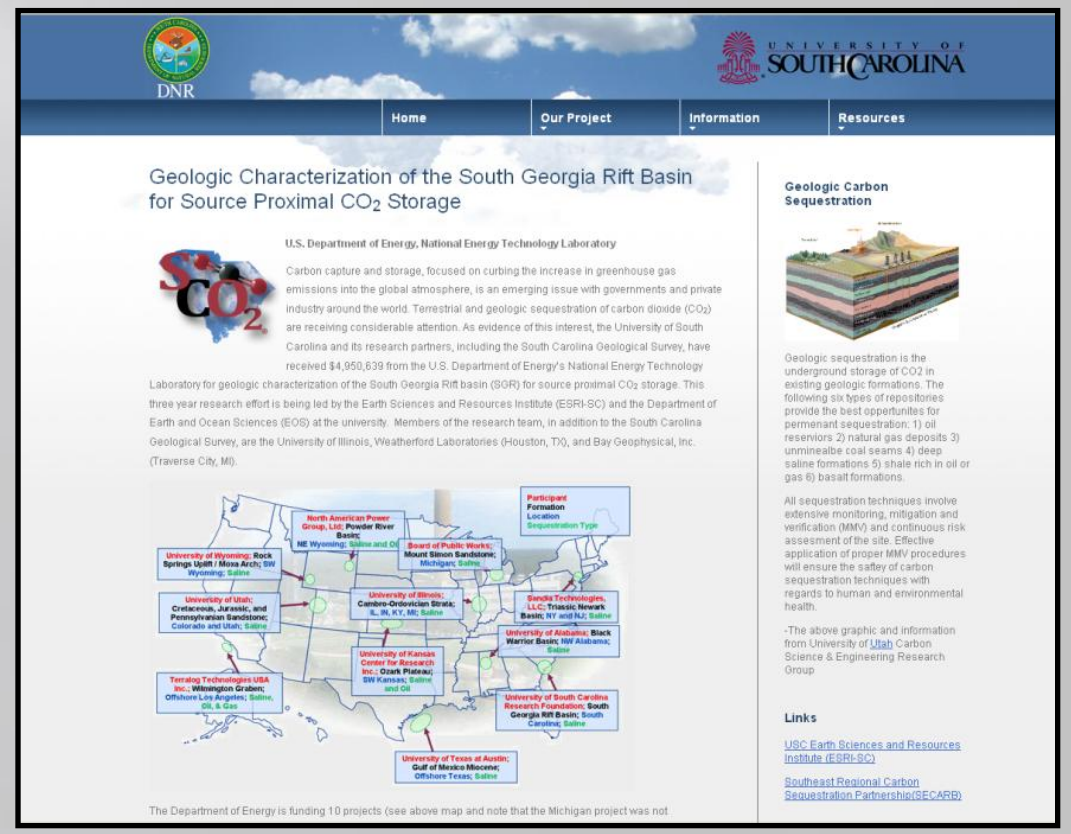


Project Data Dissemination

Interface to NATCARB Database

Project Web Site to provide data, interpretations, educational materials, videos, and presentations that track the progress of our research and can be accessed and used by a broad audience.

www.dnr.sc.gov/SCO2



Acknowledgment & Disclaimer

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Questions?